

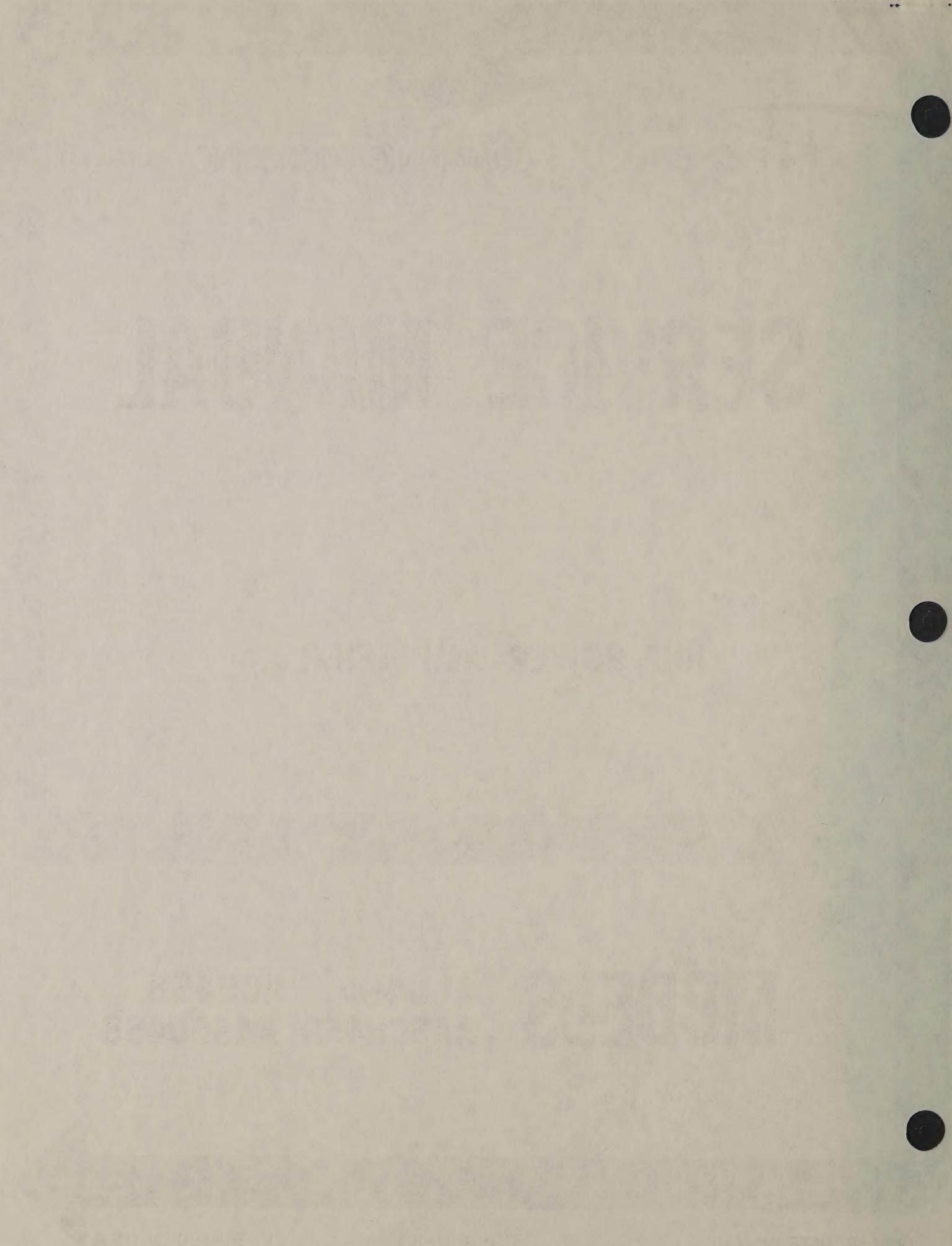
COMMUNICATIONS INC.

# SERVICE MANUAL

**UHF POWER AMPLIFIER**

**MODELS**

**ACU45A, ACU45B  
AASCU45A, AASCU45B**



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The carrier signal is generated and filtered in the frequency band 600-650 Hz. It modulates the 7. The output of Q101 is fed into a DC multiplier consisting of C101 and C102. The output of Q101 is matched to the input of the first multiplier stage with resistors R101, C103, C104 and the multiplier gain is unity.

The final multiplier consists of two stages. In each of the two stages the frequency range is multiplied by 1000. C107 is the second stage multiplier section and the output of C107 is matched to C108 with C109, C110, C111 and C112 are the multipliers. C108.

The final amplifier Q103 is connected from a voltage-controlled open circuit at the output of the Q102 by a bias determined by current source C105. The current is drawn by the Zener diode and thus the bias voltage is constant, controls the two stages feedback to the final power amplifiers Q104 and Q105 so the output with high load will not saturate and the V<sub>DS</sub> voltage and current after the power section. With the maximum voltage and current under sufficient reflected power to the output gate Q104 and Q105 can be saturated, the power output of the circuit is reduced and noise is increased.

The antenna and transmitter which isolates the receiver from the transmitter and receiver has a distance between the center of the output and the receiver about 3.5 cm. This distance both Q101 and Q102 in the position of 30 cm. From the transmitter to the antenna and receiver the distance about 15 cm. The distances both Q101 and Q102 have no influence on the results.

A low pass filter attenuates the higher order harmonics (up to at least 6db below the carrier). The filter components are C117, R118 and C119.

XII

1. spad = HOTSPADE TO SPADE 1A  
2. spad = HOTSPADES 1B  
3. spad = 141-400 - SPADES 1C  
4. spad = 141-400 - SPADES 1D  
5. spad = 141-400 - SPADES 1E  
6. spad = 141-400 - SPADES 1F

## THEORY OF OPERATION

The Regency ACU45 Series is a series of UHF power amplifiers in the UHF (450-512 MHz) communications band with a band split from 450-476 MHz, designated A and 470-512 MHz, designated B. The series is capable of amplifying an input power level of 0.5W to 45W. The ACU45A/B is designed for use with the MCCU01RA/B and MCCU01DA/B rack mount UHF transceivers. The AASCU45A/B is designed for use with the MCCU01A/B rack mount UHF transceiver. The difference between the ACU45A/B and the AASCU45A/B is that the AASCU45A/B has an additional antenna switch for simplex operation. A circuit description will follow.

The predriver (Q101) is a class C amplifier in the frequency range 450-512 MHz. It amplifies a 0.5W signal from the exciter to 3.0W with a DC collector current of 0.5A. The input match circuit consists of C101, C102 and the microstrip between them. The output of Q101 is matched to the input of the driver (Q102) with C105, C106, C112 and the microstrip between them.

The driver (Q102) is a class C amplifier in the frequency range 450-512 MHz. It amplifies the 3.0W output of Q101 to 15W with a DC collector current of 1.5A. The output of Q102 is matched to the input of the final amplifier (Q103) with C111, C113, C114, C115 and the microstrip between them.

The final amplifier (Q103) is a class C amplifier in the 450-512 MHz frequency range. It amplifies the 15W output of Q102 to 45W with a DC collector current of 7A. The output of Q103 is matched to 50 ohms with C118, C120, C123, C135 and the microstrip line.

The final amplifier (Q103) is protected from a short or open circuit at the output of the ACU45 by a VSWR detection circuit which controls the amount of drive to the ACU45 and thus its power output, Q105, controls the VSWR voltage feedback to the final device in the exciter. With a good match on the output both Q104 and Q105 are saturated and the VSWR voltage and exciter drive are both maximums. When the microstrip directional coupler senses sufficient reflected power at the output, both Q104 and Q105 come out of saturation, the power output of the ACU45 is reduced and Q103 is protected.

The antenna switch (AASCU45A/B only) isolates the receiver from the transmitter and switches the antenna between the transmitter output and the receiver input. In the transmit mode keyed 13.6 biases both CR101 and CR102 on thus providing an RF path from the transmitter to the antenna and shorting the receiver input. In receive mode both CR101 and CR102 have no bias and act as open circuits.

A low pass filter attenuates the higher order carrier harmonics to at least 60dB below the carrier. The filter components are C127, L111 and C128.

## SPECIFICATIONS

Frequency range..... 450 - 512 MHz 2 bands  
Operating Temp..... -30°C to +60°C  
Size (W-D-H)..... 19" x 10" x 5½"  
Weight..... 9.0 lbs.  
Power..... 13.6 VDC  
Current drain..... @ 13.6 VDC  
Transmit..... 10A  
Antenna..... 50 ohms

### TRANSMITTER

#### Pwr Output

@ EIA intermittent..... 45W  
@ continuous key..... 35W

DC power into final..... 100W

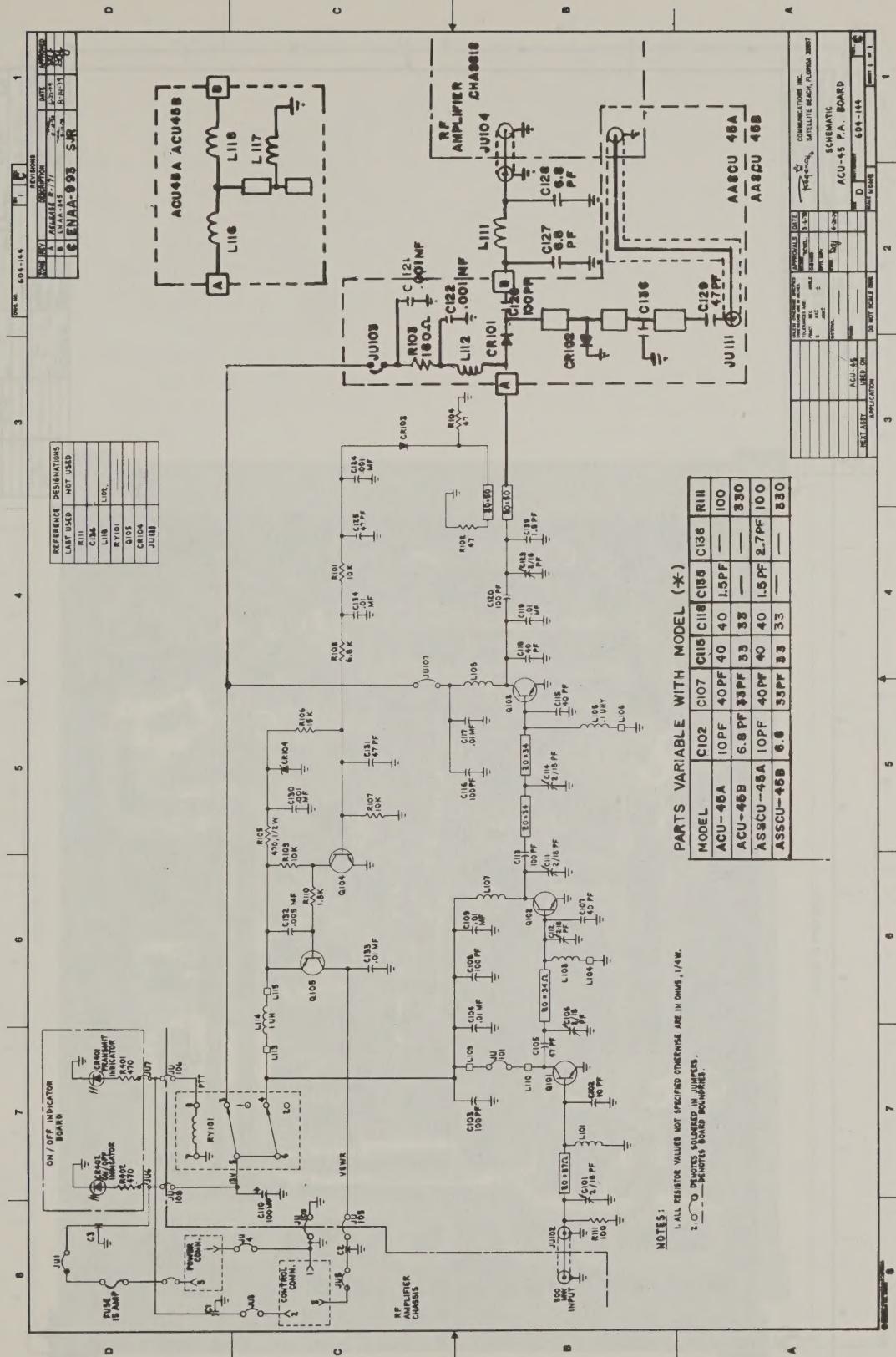
Spur & harm conducted..... -60dB max

Spur & harm radiated..... -60dB max

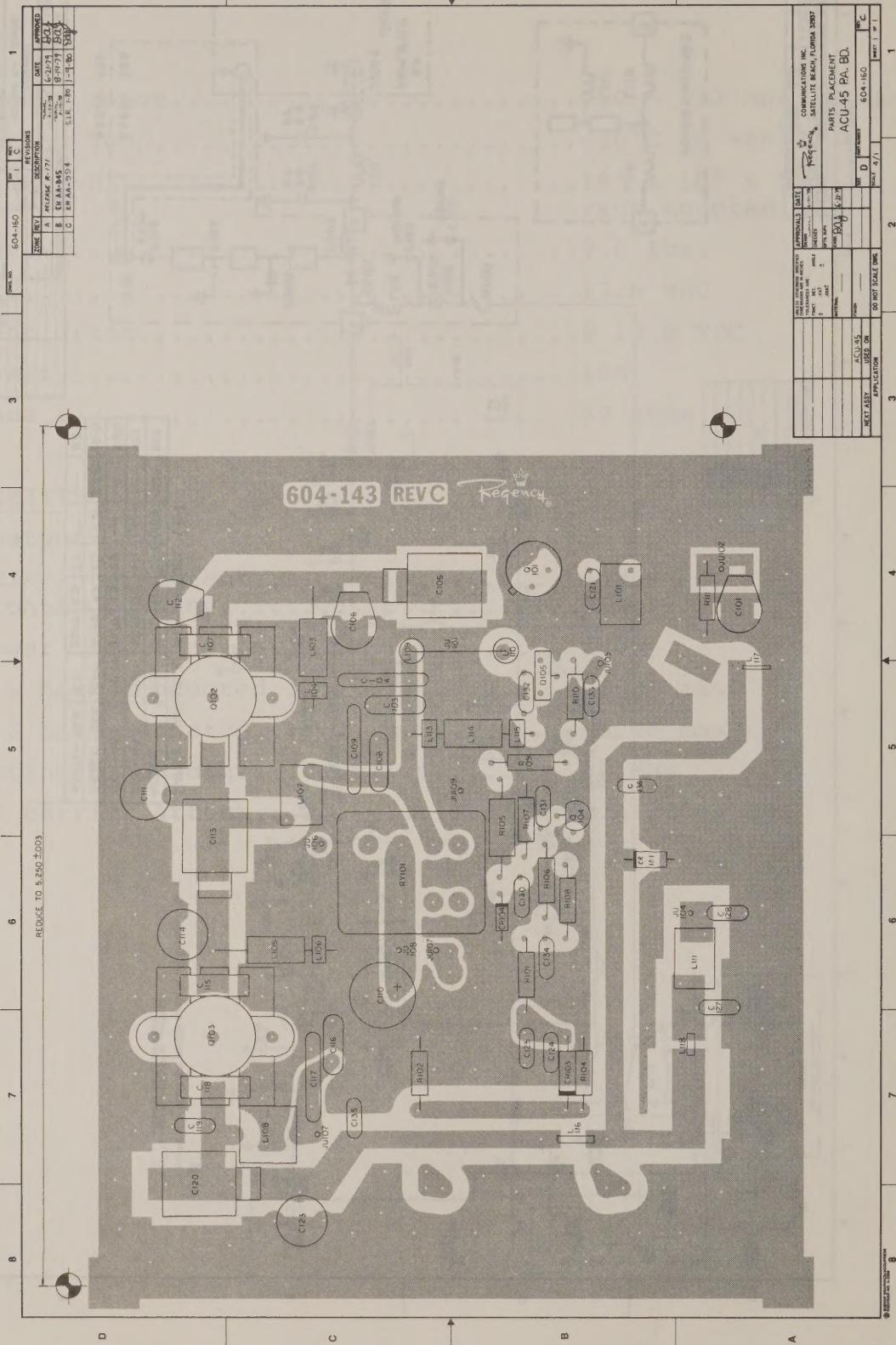
Operating bandwidth..... +5 MHz

Trans carrier attack..... EIA 100ms max

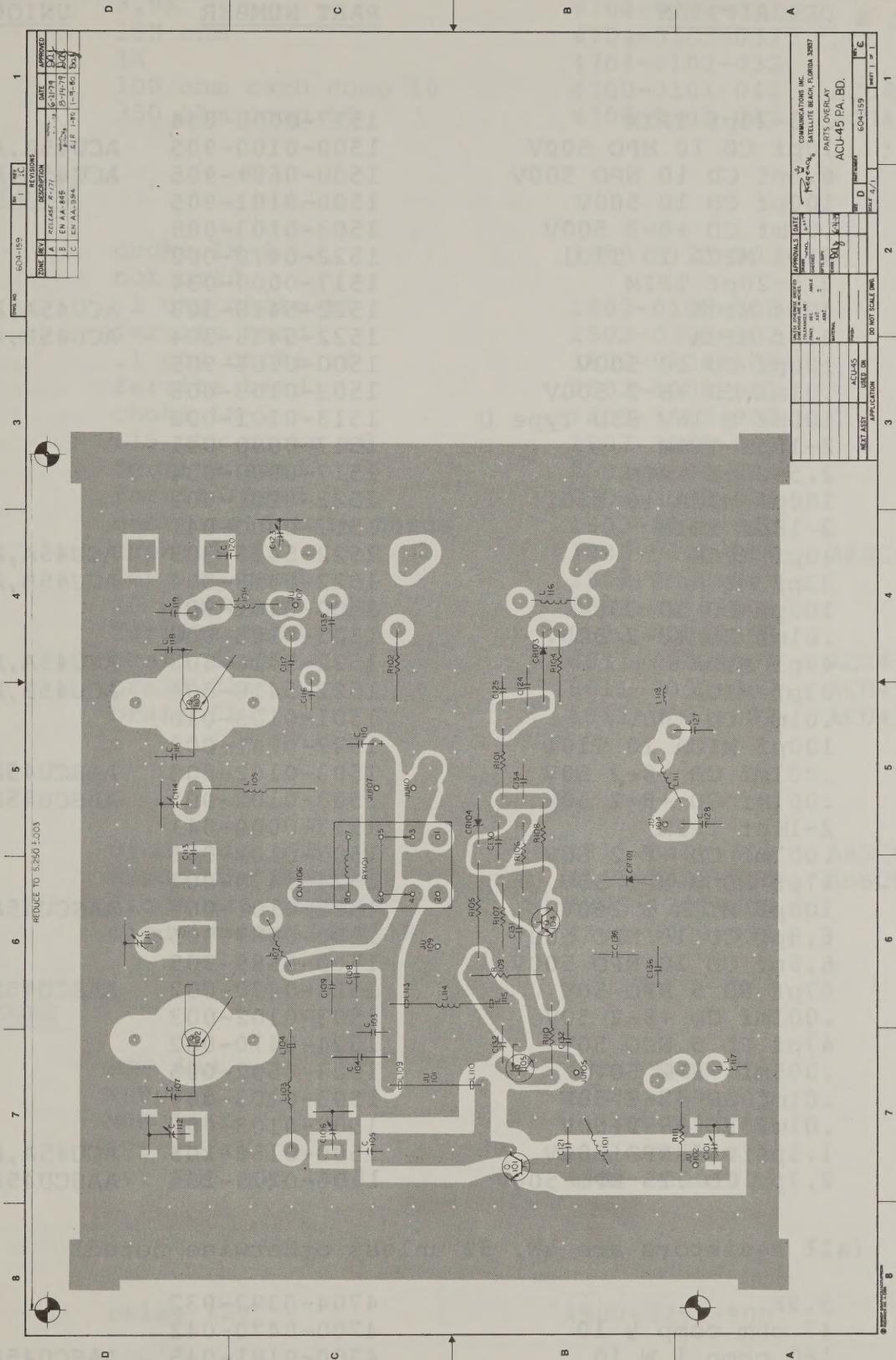
ACU45A, ACU45B  
AASCU45A, AASCU45B



ACU45A, ACU45B  
AASCU45A, AASCU45B



ACU45A, ACU45B  
AASCU45A, AASCU45B



ACU45A, ACU45B  
AASCU45A, AASCU45B

PARTS LIST

<u>LOCATION</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>	<u>MODEL(S)</u> <u>UNIQUE TO</u>
<u>CAPACITORS</u>			
C101	2.5-20pf TRIM	1517-0000-034	
C102	10pf CD 10 NPO 500V	1500-0100-905	ACU45A , AASCU45A
C102	6.8pf CD 10 NPO 500V	1500-0689-905	ACU45B , AASCU45B
C103	100pf CD 10 500V	1500-0101-905	
C104	.01mf CD +8-2 500V	1503-0103-008	
C105	47pf MICA 10 T101	1522-0470-002	
C106	2.5-20pf TRIM	1517-0000-034	
C107	40pf MICA	1522-5418-303	ACU45A , AASCU45A
C107	33pf MICA	1522-5418-304	ACU45B , AASCU45B
C108	100pf CD 10 500V	1500-0101-905	
C109	.01mf CD +8-2 500V	1503-0103-008	
C110	100mf E 16V 85D Type U	1513-0101-002	
C111	2-18pf TRIM	1517-0000-041	
C112	2.5-20pf TRIM	1517-0000-034	
C113	100pf MICA 10 T101	1522-0101-002	
C114	2-18pf TRIM	1517-0000-041	
C115	40pf MICA	1522-5418-303	ACU45A , AASCU45A
C115	33pf MICA	1522-5418-304	ACU45B , AASCU45B
C116	100pf CD 10 500V	1500-0101-905	
C117	.01mf CD +8-2 500V	1503-0103-008	
C118	40pf MICA	1522-5418-303	ACU45A , AASCU45A
C118	33pf MICA	1522-5418-304	ACU45B , AASCU45B
C119	.01mf CD 100V	1501-0103-010	
C120	100pf MICA 10 T101	1522-0101-002	
C121	.001mf CD +8-2 50V	1503-0102-003	AASCU45A , AASCU45B
C122	.001mf CD +8-2 50V	1503-0102-003	AASCU45A , AASCU45B
C123	2-18pf TRIM	1517-0000-041	
C124	.001mf CD +8-2 50V	1503-0102-003	
C125	47pf RD 5 NPO 50V	1524-0470-002	
C126	100pf MICA 5 250V	1522-0101-007	AASCU45A , AASCU45B
C127	6.8pf CD 10 NPO 500V	1500-0689-905	
C128	6.8pf CD 10 NPO 500V	1500-0689-905	
C129	47pf RD 5 NPO 50V	1524-0470-002	AASCU45A , AASCU45B
C130	.001mf CD +8-2 50V	1503-0102-003	
C131	47pf RD 5 NPO 50V	1524-0470-002	
C132	.005mf +8-2 50V	1503-0502-005	
C133	.01mf RD +8-2 50V	1503-0103-007	
C134	.01mf RD +8-2 50V	1503-0103-007	
C135	1.5pf .25 NPO 500V	1500-0159-205	ACU45A , AASCU45B
C136	2.7pf CD .25 NPO 500V	1500-0279-205	AASCU45A

RESISTORS (all resistors are  $\frac{1}{4}$ W, 5% unless otherwise noted)

R101	3.9K	4704-0392-032	
R102	47 ohm comp $\frac{1}{2}$ 10	4700-0470-042	
R103	180 comp 1 W 10	4700-0181-045	AASCU45A , AASCU45B
R104	47 ohm comp $\frac{1}{2}$ 10	4700-0470-042	
R105	470 ohm $\frac{1}{2}$ 10	4701-0471-044	
R106	15K	4704-0153-032	
R107	10K ohm	4704-0103-032	

<u>LOCATION</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>	<u>MODEL (S) UNIQUE TO</u>
R108	3.9K	4704-0392-032	
R109	10K ohm	4704-0103-032	
R110	1K	4704-0102-032	
R111	100 ohm carb comp 10	4700-0101-042	ACU45A, AASCU45A
R111	330 ohm comp 10	4700-0330-042	ACU45B, AASCU45B

#### COILS, CHOKES

L101	choke LM-2	1803-5125-902	
L102	not used		
L103	.1 uhy choke rf	1802-0108-008	
L104	ferrite bead	2502-0000-001	
L105	.1 uhy choke rf	1802-0108-008	
L106	ferrite bead	2502-0000-001	
L107	choke LM-2	1803-5125-902	
L108	.15 uhy choke rf	1803-3269-000	
L109	ferrite bead	2502-0000-001	
L110	ferrite bead	2502-0000-001	
L111	choke molder 1½ turns	1803-5125-907	
L112	choke 1 uh	1802-0010-008	AASCU45A, AASCU45B
L113	ferrite bead	2502-0000-001	
L114	10 uhy choke rf	1802-0010-008	
L115	ferrite bead	2502-0000-001	
L116	braid flat	6011-0000-002	ACU45A, ACU45B
L117	braid flat	6011-0000-002	ACU45A, ACU45B
L118	braid flat	6011-0000-002	ACU45A, ACU45B

#### DIODES

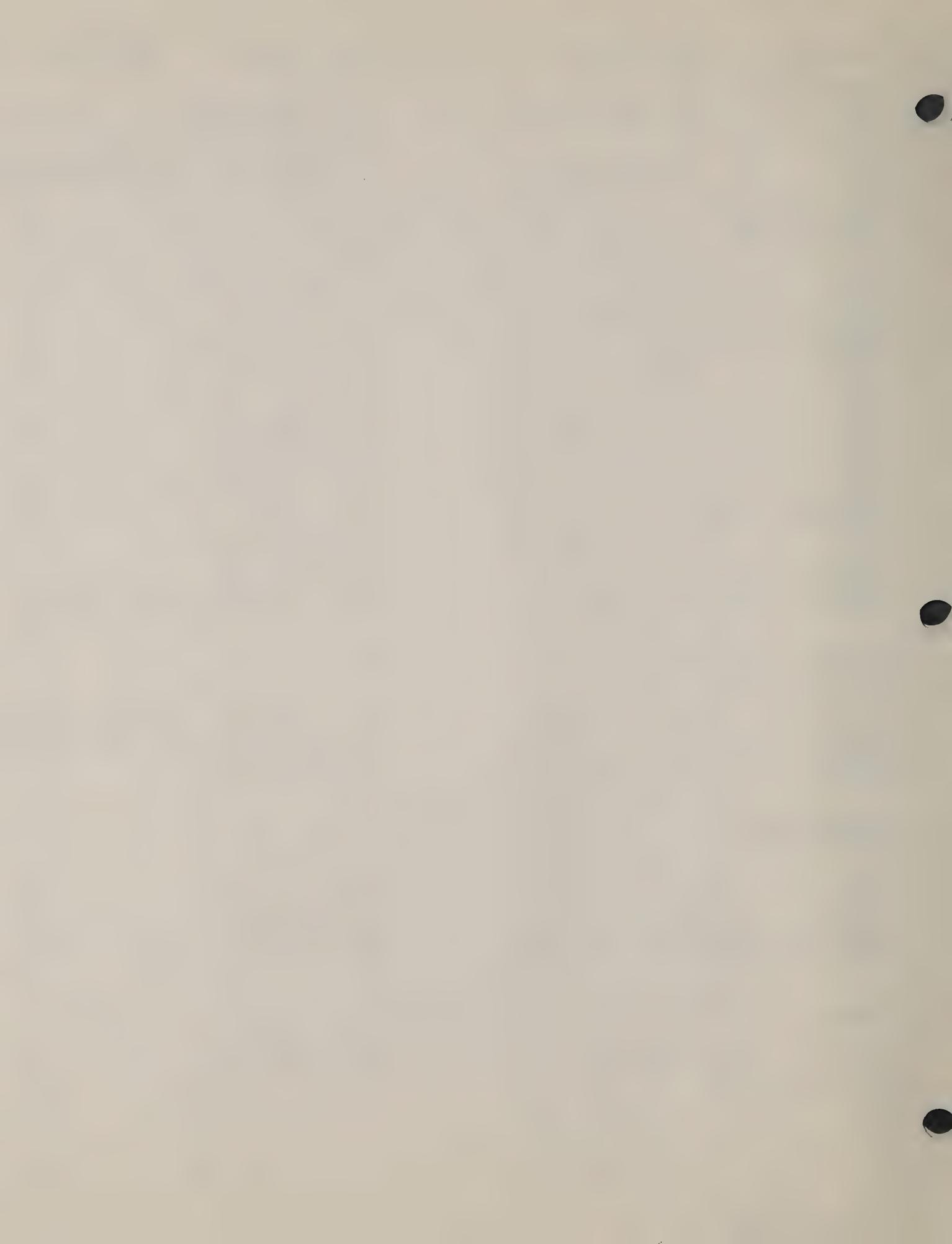
CR101	diode pin UM9484	4815-3408-600	AASCU45A, AASCU45B
CR102	diode pin UM9484	4815-3408-600	AASCU45A, AASCU45B
CR103	diode sil IN4148	4805-1241-200	
CR104	diode zener IN5231B	4804-0000-031	

#### TRANSISTORS

Q101	MRF 629	4804-3402-301	
Q102	MRF 641	4804-3269-803	
Q103	MRF 646	4804-3269-804	
Q104	SPS-951-1	4801-0000-016	
Q105	pwr PNP SJE 1608	4802-0000-003	

#### RELAY

RY101	relay 12V	4500-3251-900	
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APPLICATION		REVISIONS	
NEXT ASSY	USED ON	REV	DESCRIPTION
	ACU45	A	R200 1/1/79 JLF
		B	AB 614 2-13-81 <i>Soy</i>

## TEST PROCEDURE

## ACU45 RF POWER AMPLIFIER

## I. Test Set-Up (Refer to Figure 1)

1. ACU45 Power Amplifier
2. UHF Power Generator} MCCU01 or MCCU01R exciter tuned per instructions in
3. Pad } Service Manual. 400 mw minimum to 1.5W maximum input
4. Wattmeter UHF 1W } power range to ACU45.  
Element
5. Wattmeter UHF 100W Element
6. 50 ohm load
7. Power Supply 13.6 VDC @ 15A
8. Ammeter 15A
9. ACU45 Short Protector
10. Voltmeter 0-15V
11. Voltmeter 0-15V

## II. Test Procedure

## A. Calibration

1. Connect equipment as shown in Figure 1 with S1 in Position B and S2 in Position A.
2. Adjust RF Generator (2) to 600mw at 470 MHz on Wattmeter (4) when terminated into 50 ohms.
3. Set Power Supply (7) to 13.6 VDC at 10A at input to ACU45 with Voltmeter (10).
4. Calibrate power readings on Output Wattmeter (5).

## B. Short Circuit and Led Test

1. Connect P1 and P2 to ACU 45. Set S1 to Position A. The On and Transmit Leds should light. If D2 (red) on the test box is on the DC power input is shorted to ground.
2. Switch S1 to Position B; the bypass D 3 (green) should be on.

## C. Power Output Test

1. Connect RF input and output cables, DC power and control cables to ACU45.  
Set trimmer capacitors as follows:  
C106, C123 Minimum capacitance  
C111, C112, C114  $\frac{1}{2}$  maximum capacitance  
Set S1 in Position C, S2 in B.
2. Set Wattmeter (3) to read reflected power. Apply RF input power. Tune C101 for minimum reflected power.

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES.  
TOLERANCES ARE

FRACT. DEC ANG.  
 $\pm .XX\pm$   $\pm .XXX\pm$

APPROVALS	DATE
DRAWN <i>CM</i>	1/29/81
CHECKED	
DFTG. SUPV.	

COMMUNICATIONS INC.  
SATELLITE BEACH, FLORIDA 32937

## TEST PROCEDURE

## ACU45 RF POWER AMPLIFIER

SIZE	PART NUMBER	REV.
A	TP-14-248	B

SCALE

SHEET 1 OF 5

DO NOT SCALE DRWG.

3. Tune trimmer capacitors for maximum forward power on Wattmeter (5) in this order: C112, C114, C123, C111 and C106.
4. Minimum acceptable forward power on Wattmeter is 45W.
5. Maximum acceptable current on Ammeter (8) is 12A. Fine tune for minimum current with no degradation in power out.
6. To tune for 50W maximum power, set power out to 50W by tuning C123 toward maximum capacitance from its maximum power position for minimum current.

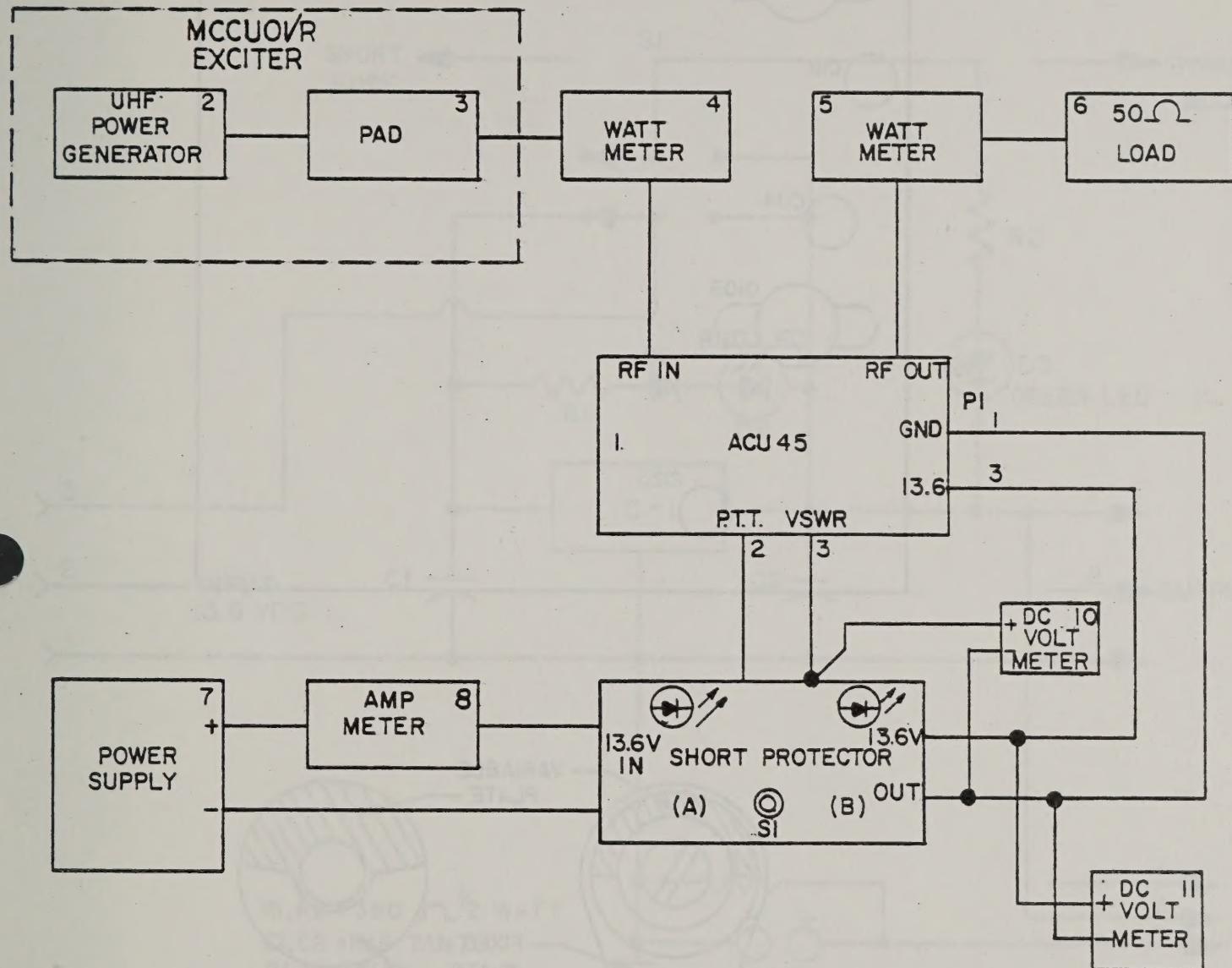
**D. SWR Circuit Test**

1. With 45W power output the Voltmeter (10) should read 13.6V.
2. Pull coax at Wattmeter (5). Voltmeter (10) should read 5.0V or less.

**E. Table of Performance Limits**

Parameter	Min	Type	Max.	Unit
RF Power Out	45		55	W
DC Current	7		12	A
VSWR Forward	13.2			VDC
VSWR Cable Pulled	0.2		5.0	VDC

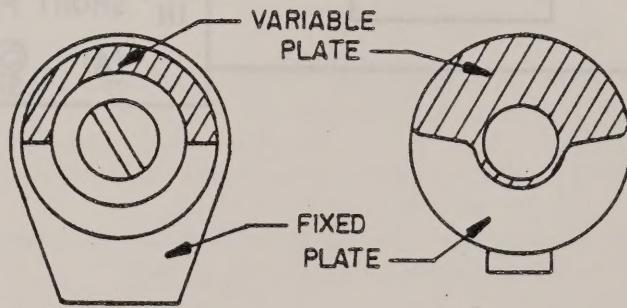
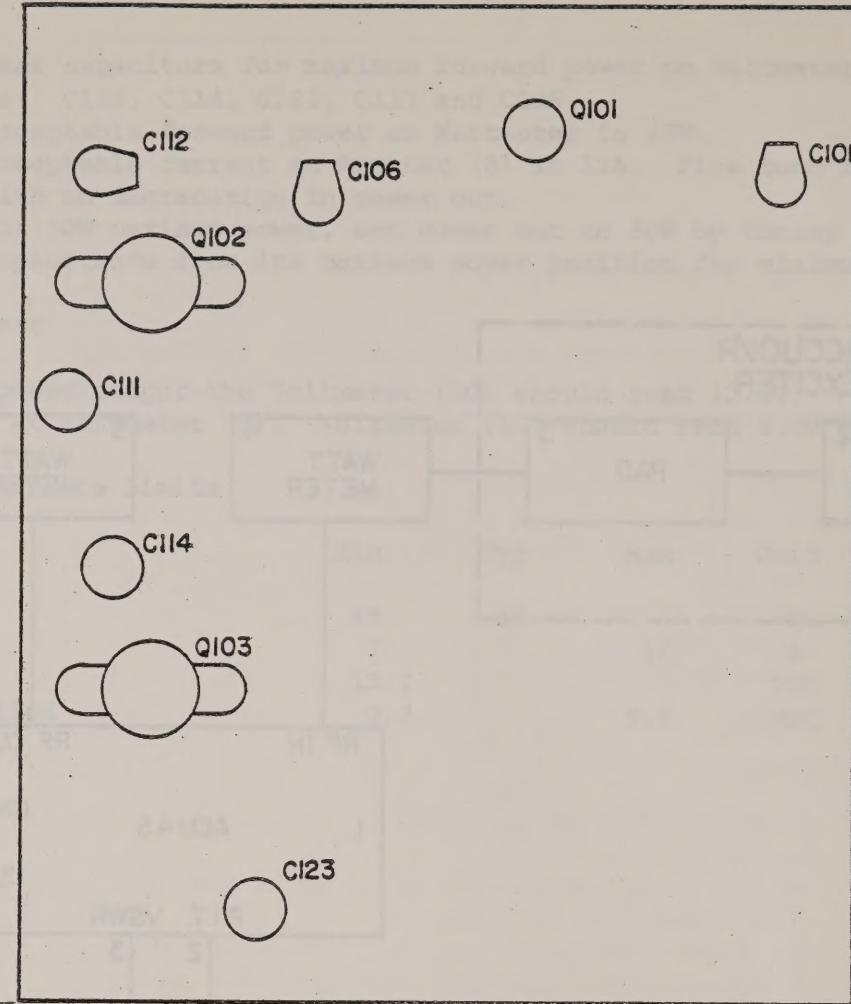
DRAWN	GM	DATE 1/29/81	SIZE A	PART NUMBER TP-14-248	REV. B
APPROVED <i>DAD</i>		DATE 2-13-81			
DO NOT SCALE DWG.		SCALE			SHEET 2



TEST INTERCONNECTION DIAGRAM

FIGURE - I

DRAWN	<i>LH</i>	DATE	7-19-79	SIZE	A	PART NUMBER	TP 14-248	REV.
APPROVED	DLF	DATE	11/19/79					B
DO NOT SCALE DWG.		SCALE						SHEET 3



STYLE OF C106 &amp; CII2

STYLE OF CIII, CII4 &amp; CI23

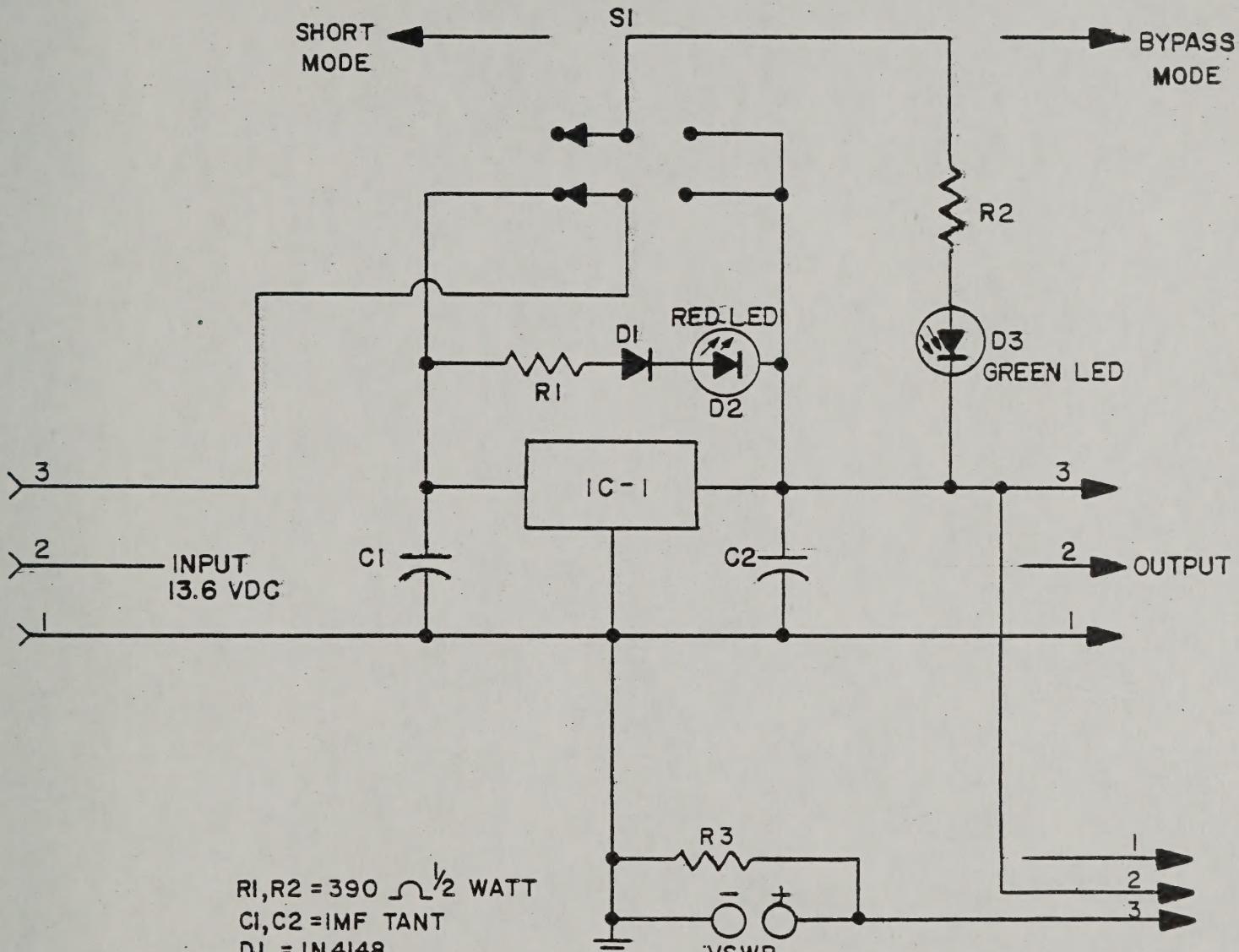
MINIMUM CAPACITANCE SETTING

TUNING ADJUSTMENT LOCATIONS ACU-45

DRAWN CMcC	DATE 9-24-79	SIZE A	PART NUMBER	REV. B
APPROVED DLF	DATE 11/19/79		TP 14-248	
DO NOT SCALE DWG.		SCALE ~		SHEET 4

## SCHEMATIC FOR ACU 45 TEST BOX

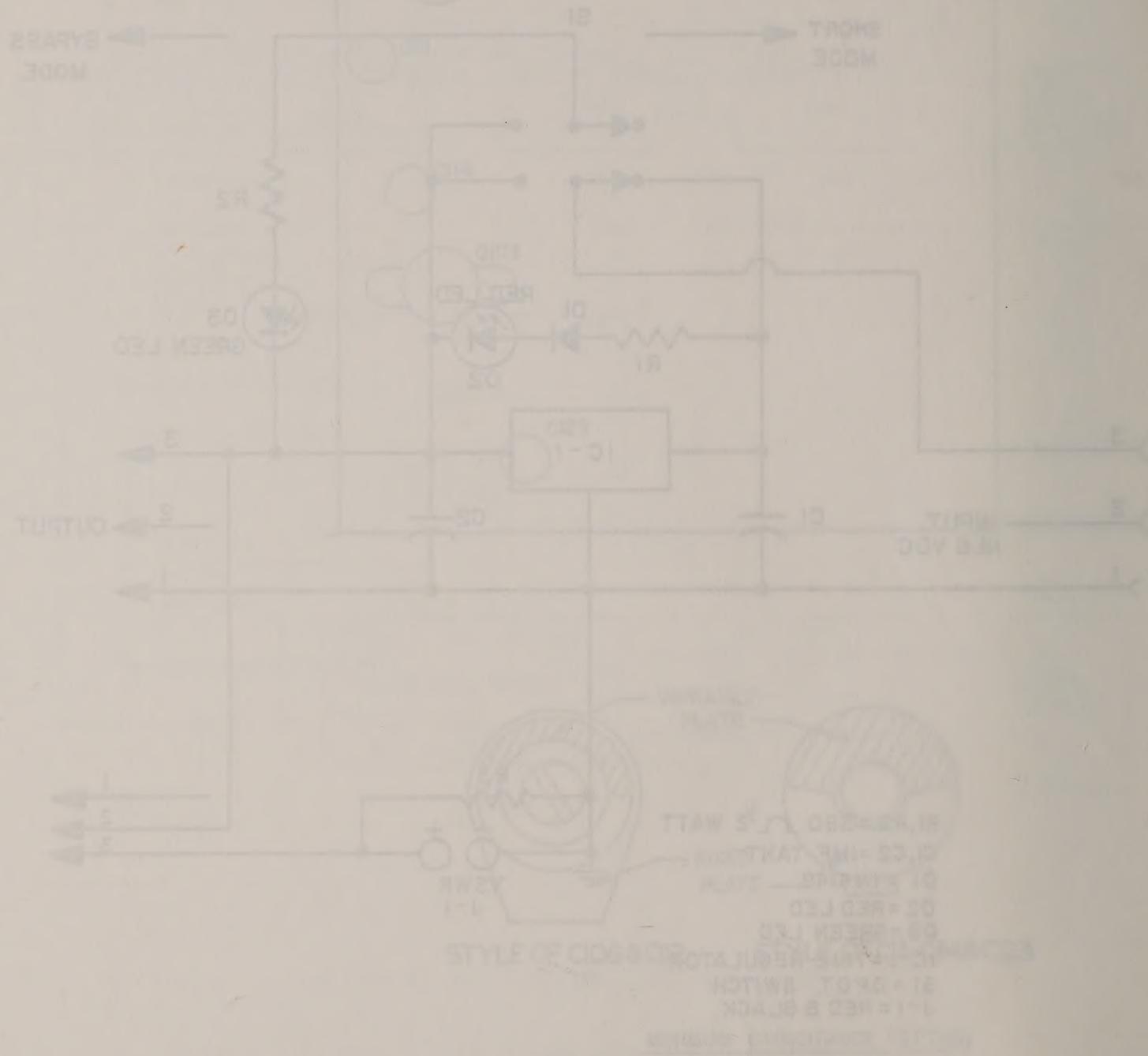
TP-14-248



R<sub>1</sub>,R<sub>2</sub> = 390 Ω 1/2 WATT  
 C<sub>1</sub>,C<sub>2</sub> = 1μF TANT  
 D<sub>1</sub> = IN 4148  
 D<sub>2</sub> = RED LED  
 D<sub>3</sub> = GREEN LED  
 IC-1 = 7812 REGULATOR  
 S<sub>1</sub> = D.P.D.T. SWITCH  
 J-1 = RED & BLACK

## **FIGURE - 2**

DRAWN	8DK	DATE	11-19-79	SIZE	A	PART NUMBER		REV.
APPROVED	DLF	DATE	11/20/79			RP 14-248		B
DO NOT SCALE DWG.				SCALE			SHEET	5



TUNING ADJUSTMENT LOCATIONS: A-A' & B-B'

S-201419